Section 6. Test Characteristics

The analyses in this section include internal consistency reliability, decision consistency, decision accuracy, and exploratory factor analyses. Results for the May administration are presented for both the Target populations and Linking samples. Results from the Summer administration are presented for each content area by form for the Target population only. Factor analyses were not conducted for the Summer administration.

Reliability

The general concept of reliability concerns the precision of a test score. Of interest is quantifying the degree to which a score will vary from an average result obtained over many testing occasions due to random factors (Haertel, 2006). There are a variety of theories and methods that can be used to estimate reliability.

Classical test theory defines reliability as the proportion of total score variance that is true-score variance. Several different ways of estimating this proportion exist. The estimate of reliability given in this report is Cronbach's alpha (Cronbach, 1951), an internal consistency measure. It is derived from analysis of the consistency of performance over items within a test and provides a lower-bound estimate of a test's reliability. Cronbach's alpha can be expressed as

$$\alpha = \frac{n}{n-1}\left[1 - \frac{\sum_{i=1}^{n} \sigma_i^{\,2}}{\sigma_x^2}\right],$$

where n is the number of items, σ_i^2 is the variance of scores on the *i*-th item, and σ_x^2 is the variance of the total score (sum of scores on the individual items).

Values for Cronbach's alpha were calculated for each test form, test group, and selected subgroups. The results for the reliability analyses are presented along with other summary statistics in Tables 7.12 to 7.23 of Section 7. The tables show that the reliability coefficients for the May results ranged from 0.71 to 0.79 for the Target populations and from 0.86 to 0.89 for the Linking samples; the reliability coefficients for the Summer results ranged from 0.69 to 0.80.

Decision Accuracy and Decision Consistency

The accuracy of decisions based on specified cut-scores was assessed for Reliability of Classification using the ETS computer program RELCLASS. RELCLASS provides two statistics that describe the reliability of classifications based on test scores (Livingston & Lewis, 1995). More specifically, information from an administration of one form is used to estimate the following:

1) Decision Accuracy describes the extent to which examinees are classified in the same way as they would be on the basis of the average of all possible forms of a test. Decision accuracy answers the question: How does the actual classification of test takers, based on their single-form scores, agree with the classification that would be made on the basis of their true scores, if their true scores were somehow known?

2) Decision Consistency describes the extent to which examinees are classified in the same way as they would be on the basis of a single form of a test other than the one for which data are available. Decision consistency answers the question: What is the agreement between the classifications based on two non-overlapping, equally difficult forms of the test?

RELCLASS estimates decision accuracy using an estimated joint distribution of reported performance level classifications on the current form of the test and the performance level classifications based on an all-forms average (true score). RELCLASS estimates decision consistency using an estimated joint distribution of reported performance level classifications on the current form of the test and performance level classifications on an alternate (parallel) form. In each case, the proportion of performance level classifications with exact agreement is the sum of the entries in the diagonal of the contingency table representing the joint distribution.

RELCLASS results were calculated using student scale scores derived from item pattern (IP) score distributions, for each form and content area. In four cases, the RELCLASS program would not converge due to the nature of the data (e.g., small sample sizes, and/or skewed performance distributions). The four exceptions were: Biology, Form 208 taken by the May Target population, Government, Form 208 taken by the May Linking sample, and Biology and English, Forms 308 taken by the summer Target populations. RELCLASS models unimodal data, and the IP scores for these tests did not appear to match this model. As an approximation to the RELCLASS results based on IP scoring, decision accuracy and consistency analyses for these four forms were obtained using raw score-to-scale score conversion tables. In all but one case (Biology, Form 308 taken by the Summer Target population) RELCLASS was able to converge using these RS-SS scores. Comparisons between the consistency and accuracy results obtained using IP and RS-SS scoring for the other HSA and Mod-HSA forms indicated that the two approaches typically produced findings that differed by 1% or less. However, because operational scores are based on IP scoring, results based on RS-SS should be regarded as an approximation.

Results are provided in Tables 6.1 to 6.12 for each group of students by form and content area for the May administration and by content area for the Target population of the Summer administration. Results from the Summer administration are provided for Form 308 only; very small numbers of students took Form 408. The tables show decision accuracy values which describe the agreement between classifications based on an observable variable (scores on one form of a test) and classifications based on an

unobservable variable (the test takers' true scores). For Target students in the May administration, decision accuracy values ranged from 0.85 to 0.89 across all performance levels and content areas and from 0.82 to 0.91 for the Proficient and Advanced classifications in Algebra, Biology and English. For Linking students in the May administration, decision accuracy values ranged from 0.74 to 0.86 across all performance levels and content areas and from 0.86 to 0.90 for the Proficient and Advanced classifications in Algebra, Biology and English. For Target students in the Summer administration, decision accuracy values ranged from 0.87 to 0.90 across all performance levels for Algebra, English, and Government, and from 0.82 to 0.91 for the Proficient and Advanced classifications in Algebra and English.[8]

Decision consistency values describe the agreement between classifications based on two variables (scores on the form students have taken and a parallel form of the same test that is not administered to the students). For Target students in the May administration, decision consistency values ranged from 0.79 to 0.85 across all performance levels and content areas and from 0.82 to 0.87 for the Proficient and Advanced classifications in Algebra, Biology and English. For Linking students in the May administration, decision consistency values ranged from 0.68 to 0.82 across all performance levels and content areas and from 0.81 to 0.86 for the Proficient and Advanced classifications in Algebra, Biology and English. For Target students in the Summer administration, decision consistency values ranged from 0.79 to 0.85 across all performance levels for Algebra, English, and Government, and from 0.82 to 0.87 for the Proficient and Advanced classifications in Algebra and English.

Note that in all cases the decision accuracy indices are somewhat larger than the decision consistency indices. This is due to differences in the estimation procedures. The estimation procedure for decision accuracy includes a random component on one of the two variables, whereas in estimating decision consistency each variable includes a random component (Livingston & Lewis, 1995).

[8] RELCLASS did not converge for Biology for the Summer Target population.

Table 6.1 Decision Accuracy and Consistency: May, Algebra Linking

	Placement Scores	Estimated Proportion Within Category			
		Advanced	Proficient	Basic	Category Total
Form 108					
Decision Accuracy	450 - 650	0.15	0.02	0.00	0.16
	412 - 449	0.07	0.33	0.11	0.50
	240 - 411	0.00	0.02	0.31	0.33
	Estimated Proportion Correctly Classified = 0.79 ; Proficient & Above = 0.88				
Decision Consistency	450 - 650	0.14	0.03	0.00	0.16
	412 - 449	0.09	0.28	0.13	0.50
	240 - 411	0.00	0.04	0.29	0.33
	Estimated Proportion Consistently Classified = 0.71 ; Proficient & Above = 0.83				
Form 208					
Decision Accuracy	450 - 650	0.12	0.03	0.00	0.15
	412 - 449	0.06	0.34	0.09	0.50
	240 - 411	0.00	0.03	0.32	0.35
	Estimated Proportion Correctly Classified = 0.79 ; Proficient & Above = 0.88				
Decision Consistency	450 - 650	0.11	0.04	0.00	0.15
	412 - 449	0.08	0.29	0.12	0.50
	240 - 411	0.00	0.05	0.30	0.35
	Estimated Proportion Consistently Classified = 0.71 ; Proficient & Above = 0.83				

*Inconsistencies within category cell entries are due to rounding.

Table 6.2 Decision Accuracy and Consistency: May, Algebra Target

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 108					
Decision Accuracy	450 - 650	0.01	0.00	0.00	0.01
	412 - 449	0.02	0.05	0.03	0.10
	240 - 411	0.01	0.05	0.83	0.89
	Estimated Proportion Correctly Classified = 0.89 ; Proficient & Above = 0.91				
Decision Consistency	450 - 650	0.01	0.00	0.00	0.01
	412 - 449	0.02	0.04	0.04	0.10
	240 - 411	0.02	0.07	0.80	0.89
	Estimated Proportion Consistently Classified = 0.85 ; Proficient & Above = 0.87				
Form 208					
Decision Accuracy	450 - 650	0.00	0.00	0.00	0.00
	412 - 449	0.01	0.05	0.03	0.09
	240 - 411	0.01	0.05	0.85	0.91
	Estimated Proportion Correctly Classified = 0.89 ; Proficient & Above = 0.91				
Decision Consistency	450 - 650	0.00	0.00	0.00	0.00
	412 - 449	0.02	0.04	0.03	0.09
	240 - 411	0.02	0.07	0.82	0.91
	Estimated Proportion Consistently Classified = 0.85 ; Proficient & Above = 0.87				

*Inconsistencies within category cell entries are due to rounding.

Table 6.3 Decision Accuracy and Consistency: Summer, Algebra Target

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 308					
Decision Accuracy	450 - 650	0.01	0.00	0.00	0.01
	412 - 449	0.00	0.05	0.01	0.07
	240 - 411	0.02	0.07	0.83	0.92
	Estimated Proportion Correctly Classified = 0.90 ; Proficient & Above = 0.90				
Decision Consistency	450 - 650	0.01	0.00	0.00	0.01
	412 - 449	0.01	0.04	0.02	0.07
	240 - 411	0.03	0.09	0.80	0.92
	Estimated Proportion Consistently Classified = 0.85 ; Proficient & Above = 0.86				
Form 408	Insufficient Sample Size (N = 3)				

*Inconsistencies within category cell entries are due to rounding.

Table 6.4 Decision Accuracy and Consistency: May, Biology Linking

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 108					
Decision Accuracy	452 - 650	0.14	0.04	0.00	0.18
	400 - 451	0.06	0.45	0.06	0.57
	240 - 399	0.00	0.04	0.22	0.25
	Estimated Proportion Correctly Classified = 0.80 ; Proficient & Above = 0.90				
Decision Consistency	452 - 650	0.13	0.05	0.00	0.18
	400 - 451	0.09	0.40	0.09	0.57
	240 - 399	0.00	0.05	0.20	0.25
	Estimated Proportion Consistently Classified = 0.73 ; Proficient & Above = 0.86				
Form 208					
Decision Accuracy	452 - 650	0.14	0.03	0.00	0.16
	400 - 451	0.08	0.43	0.08	0.59
	240 - 399	0.00	0.03	0.22	0.25
	Estimated Proportion Correctly Classified = 0.79 ; Proficient & Above = 0.90				
Decision Consistency	452 - 650	0.12	0.04	0.00	0.16
	400 - 451	0.11	0.	0.10	0.59
	240 - 399	0.00	0.04	0.21	0.25
	Estimated Proportion Consistently Classified = 0.71 ; Proficient & Above = 0.86				

*Inconsistencies within category cell entries are due to rounding.

Table 6.5 Decision Accuracy and Consistency: May, Biology Target

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 108					
Decision Accuracy	452 - 650	0.00	0.00	0.00	0.00
	400 - 451	0.01	0.08	0.06	0.15
	240 - 399	0.01	0.06	0.78	0.85
	Estimated Proportion Correctly Classified = 0.86 ; Proficient & Above = 0.87				
Decision Consistency	452 - 650	0.00	0.00	0.00	0.00
	400 - 451	0.02	0.07	0.06	0.15
	240 - 399	0.02	0.09	0.74	0.85
	Estimated Proportion Consistently Classified = 0.80 ; Proficient & Above = 0.83				
Form 208**					
Decision Accuracy	452 - 650	0.00	0.00	0.00	0.00
	400 - 451	0.02	0.10	0.07	0.20
	240 - 399	0.01	0.06	0.74	0.80
	Estimated Proportion Correctly Classified = 0.85 ; Proficient & Above = 0.87				
Decision Consistency	452 - 650	0.00	0.00	0.00	0.00
	400 - 451	0.04	0.08	0.08	0.20
	240 - 399	0.01	0.09	0.70	0.80
	Estimated Proportion Consistently Classified = 0.79 ; Proficient & Above = 0.82				

*Inconsistencies within category cell entries are due to rounding.
**Results calculated using scores from a raw score-to-scale score conversion table.

Table 6.6 Decision Accuracy and Consistency: Summer, Biology Target

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 308	RELCLASS would not converge for this data				
Form 408	Insufficient Sample Size (N = 2)				

Table 6.7 Decision Accuracy and Consistency: May, English Linking

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 108					
Decision Accuracy	429 - 650	0.21	0.03	0.00	0.24
	396 - 428	0.08	0.27	0.08	0.43
	240 - 395	0.00	0.03	0.30	0.33
	Estimated Proportion Correctly Classified = 0.78 ; Proficient & Above = 0.89				
Decision Consistency	429 - 650	0.20	0.04	0.00	0.24
	396 - 428	0.10	0.22	0.10	0.43
	240 - 395	0.00	0.05	0.28	0.33
	Estimated Proportion Consistently Classified = 0.71 ; Proficient & Above = 0.85				
Form 208					
Decision Accuracy	429 - 650	0.19	0.05	0.00	0.24
	396 - 428	0.05	0.24	0.14	0.43
	240 - 395	0.00	0.00	0.32	0.32
	Estimated Proportion Correctly Classified = 0.76 ; Proficient & Above = 0.86				
Decision Consistency	429 - 650	0.19	0.05	0.00	0.24
	396 - 428	0.07	0.21	0.15	0.43
	240 - 395	0.00	0.04	0.29	0.32
	Estimated Proportion Consistently Classified = 0.68 ; Proficient & Above = 0.81				

*Inconsistencies within category cell entries are due to rounding.

Table 6.8 Decision Accuracy and Consistency: May, English Target

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 108					
Decision Accuracy	429 - 650	0.00	0.00	0.00	0.00
	396 - 428	0.01	0.04	0.04	0.09
	240 - 395	0.02	0.05	0.84	0.91
	Estimated Proportion Correctly Classified = 0.88 ; Proficient & Above = 0.90				
Decision Consistency	429 - 650	0.00	0.00	0.00	0.00
	396 - 428	0.02	0.03	0.04	0.09
	240 - 395	0.03	0.08	0.80	0.91
	Estimated Proportion Consistently Classified = 0.84 ; Proficient & Above = 0.86				
Form 208					
Decision Accuracy	429 - 650	0.00	0.00	0.00	0.00
	396 - 428	0.01	0.06	0.04	0.12
	240 - 395	0.01	0.05	0.82	0.88
	Estimated Proportion Correctly Classified = 0.88 ; Proficient & Above = 0.90				
Decision Consistency	429 - 650	0.00	0.00	0.00	0.00
	396 - 428	0.02	0.05	0.04	0.12
	240 - 395	0.02	0.07	0.79	0.88
	Estimated Proportion Consistently Classified = 0.84 ; Proficient & Above = 0.86				

*Inconsistencies within category cell entries are due to rounding.

Table 6.9 Decision Accuracy and Consistency: Summer, English Target

		Estimated Proportion Within Category			
	Placement Scores	Advanced	Proficient	Basic	Category Total
Form 308**					
Decision Accuracy	429 - 650	0.00	0.00	0.00	0.00
	396 - 428	0.01	0.04	0.04	0.09
	240 - 395	0.02	0.05	0.84	0.91
	Estimated Proportion Correctly Classified = 0.88 ; Proficient & Above = 0.89				
Decision Consistency	429 - 650	0.00	0.00	0.00	0.00
	396 - 428	0.02	0.03	0.04	0.09
	240 - 395	0.03	0.08	0.80	0.91
	Estimated Proportion Correctly Classified = 0.83 ; Proficient & Above = 0.85				
Form 408	Insufficient Sample Size (N = 2)				

*Inconsistencies within category cell entries are due to rounding.
**Results calculated using scores from a raw score-to-scale score conversion table.

Table 6.10 Decision Accuracy and Consistency: May, Government Linking

		Estimated Proportion Within Category		
	Placement Scores	Proficient	Basic	Category Total
Form 108				
Decision Accuracy	394 - 650	0.67	0.14	0.81
	240 - 393	0.00	0.19	0.19
	Estimated Proportion Correctly Classified = 0.86			
Decision Consistency	394 - 650	0.66	0.15	0.81
	240 - 393	0.02	0.17	0.19
	Estimated Proportion Consistently Classified = 0.82			
Form 208**				
Decision Accuracy	394 - 650	0.73	0.08	0.81
	240 - 393	0.18	0.01	0.19
	Estimated Proportion Correctly Classified = 0.74			
Decision Consistency	394 - 650	0.61	0.19	0.81
	240 - 393	0.11	0.09	0.19
	Estimated Proportion Consistently Classified = 0.70			

*Inconsistencies within category cell entries are due to rounding.
**Results calculated using scores from a raw score-to-scale score conversion table.

Table 6.11 Decision Accuracy and Consistency: May, Government Target

		Estimated Proportion Within Category		
	Placement Scores	Proficient	Basic	Category Total
Form 108				
Decision Accuracy	394 - 650	0.16	0.06	0.22
	240 - 393	0.05	0.73	0.78
	Estimated Proportion Correctly Classified = 0.89			
Decision Consistency	394 - 650	0.15	0.07	0.22
	240 - 393	0.09	0.70	0.78
	Estimated Proportion Consistently Classified = 0.84			
Form 208				
Decision Accuracy	394 - 650	0.13	0.05	0.18
	240 - 393	0.06	0.76	0.82
	Estimated Proportion Correctly Classified = 0.89			
Decision Consistency	394 - 650	0.12	0.05	0.18
	240 - 393	0.10	0.73	0.82
	Estimated Proportion Consistently Classified = 0.85			

*Inconsistencies within category cell entries are due to rounding.

Table 6.12 Decision Accuracy and Consistency: Summer, Government Target

		Estimated Proportion Within Category		
	Placement Scores	Proficient	Basic	Category Total
Form 308				
Decision Accuracy	394 - 650	0.16	0.04	0.20
	240 - 393	0.08	0.72	0.80
	Estimated Proportion Correctly Classified = 0.87			
Decision Consistency	394 - 650	0.15	0.06	0.20
	240 - 393	0.12	0.68	0.80
	Estimated Proportion Consistently Classified = 0.82			
Form 408	Insufficient Sample Size (N = 1)			

*Inconsistencies within category cell entries are due to rounding.

Exploratory Factor Analysis

To investigate the dimensionality of the Mod-HSA operational forms created after the May administration, exploratory factor analyses were conducted at the item level for each 50-item operational form created after the May 2008 test administration. The software program MPLUS (Muthén & Muthén, 2007) was used to generate tetrachoric correlations that were then read into the program for the analyses. Two groups of students, the Target populations and the Linking samples, were analyzed separately. The estimator used in these exploratory analyses was a weighted least-squares with mean and variance adjustment (Muthén, DuToit, & Spisic, 1997). This estimator was specifically designed for the analysis of ordered categorical data. Solutions were rotated by Quartimin methods, because the factors were expected to be correlated.

The percentage of score variance accounted for by each factor having an eigenvalue greater than 1.0 is shown in Tables 6.13 to 6.20 for each form. The decision to include only eigenvalues greater than 1.0 follows the Kaiser-Guttman rule (Kaiser, 1960). Scree plots (Catell, 1966) for each form are given in Figures 6.1 to 6.16 for the first 50 factors extracted. The scree plot involves plotting the eigenvalues of the factors extracted in order of magnitude from high to low. The plot is examined for a point at which the decrease in eigenvalues levels off. Factors prior to this point are considered important because of the variance they explain. Factors at and beyond this point add relatively little information.

Examination of the plots and tables for the Linking samples shows that the eigenvalues for the first factors ranged from about 12.0 to 15.6 across forms and subject areas, and these first factors accounted for 24% to 31% of the variance. The eigenvalues for the second and subsequent factors were no greater than about 2.0, and these factors accounted for about 2% to 5% of the remaining variance. Results for the two forms taken by the Linking samples were very similar across forms. The sizable amount of variance accounted for by the first factor indicates a large first factor; confirmatory factor analyses

or a study of the essential dimensionality of the data for the Linking samples could be used to assess the fit of a single factor model to the data.

With regard to the Target populations, the first factor results tended to be about half of those obtained for the Linking samples. Specifically, the eigenvalues for the first factors ranged from about 5.5 to 7.0, and this factor accounted for about 11% to 14% of the variance. Thus, for the Target populations a much smaller first factor was found. Like the Linking samples, the second and subsequent factors had small eigenvalues and accounted for 4% or less of the remaining variance.

The lower eigenvalues and percentages of score variance accounted for by the first factor in the Target populations appears to be a product of the difficulty of the Mod-HSA items for students in the Target populations. Table 6.22 shows that for the Linking group the mean item p-values were in the low 0.70's, a moderate degree of difficulty. For the Target populations, Table 6.23 shows that they were in the high 0.40's, on average. The Mod-HSA items are multiple-choice items with three answer choices; therefore the item p-values could reflect a considerable amount of guessing.

Very difficult items discriminate less well than do moderately difficult items and introduce more error because of increased guessing. As shown in Tables 6.23 and 6.24, the Mod-HSA item point-biserials were considerably lower for the Target population than they were for the Linking sample. Also the internal consistency results were notably lower: for the Linking samples, internal consistency ranged from 0.86 to 0.89 across subject areas, whereas for the Target populations it ranged from 0.71 to 0.79. Comparison of the tetrachoric correlations read into the factor analyses and summarized in Table 6.25 also shows that the item intercorrelations for the Target population were quite low and about half the size of those observed for the Linking sample, on average. Presumably as achievement in the Target populations improves, item discrimination, internal consistency and the item intercorrelations will improve concomitantly.

Table 6.13 Factor Analysis Results for Algebra, May Linking

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	11.87	23.75	12.49	24.98
2	2.13	4.26	2.01	4.01
3	1.64	3.28	1.67	3.34
4	1.47	2.93	1.62	3.24
5	1.40	2.79	1.46	2.93
6	1.36	2.72	1.40	2.81
7	1.33	2.67	1.34	2.68
8	1.26	2.51	1.26	2.52
9	1.23	2.46	1.23	2.46
10	1.16	2.32	1.16	2.32
11	1.10	2.20	1.09	2.19
12	1.08	2.16	1.07	2.14
13	1.07	2.13	1.06	2.11
14	1.04	2.08	1.05	2.10
15	1.01	2.01		

Table 6.14 Factor Analysis Results for Algebra, May Target

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	7.08	14.17	6.48	12.96
2	1.71	3.41	2.30	4.60
3	1.66	3.31	1.81	3.62
4	1.49	2.98	1.54	3.08
5	1.43	2.86	1.47	2.95
6	1.38	2.77	1.45	2.90
7	1.34	2.68	1.40	2.80
8	1.32	2.65	1.35	2.70
9	1.26	2.52	1.31	2.63
10	1.25	2.49	1.29	2.58
11	1.21	2.42	1.26	2.52
12	1.17	2.34	1.22	2.44
13	1.11	2.22	1.18	2.36
14	1.10	2.20	1.12	2.24
15	1.07	2.14	1.11	2.22
16	1.04	2.08	1.09	2.18
17	1.01	2.02	1.08	2.16
18			1.07	2.14
19			1.01	2.03

Table 6.15 Factor Analysis Results for Biology, May Linking

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	12.28	24.57	12.04	24.07
2	1.54	3.08	1.77	3.53
3	1.50	2.99	1.56	3.12
4	1.42	2.84	1.52	3.05
5	1.39	2.78	1.32	2.63
6	1.35	2.71	1.29	2.58
7	1.29	2.58	1.21	2.42
8	1.26	2.51	1.19	2.38
9	1.18	2.36	1.17	2.34
10	1.13	2.27	1.12	2.24
11	1.10	2.20	1.11	2.23
12	1.08	2.16	1.08	2.16
13	1.07	2.14	1.06	2.13
14	1.04	2.09	1.03	2.05
15	1.00	2.00	1.01	2.02

Table 6.16 Factor Analysis Results for Biology, May Target

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	5.55	11.11	6.23	12.45
2	1.81	3.61	1.79	3.58
3	1.63	3.27	1.69	3.38
4	1.59	3.17	1.53	3.05
5	1.50	2.99	1.48	2.96
6	1.49	2.97	1.45	2.90
7	1.43	2.87	1.42	2.84
8	1.40	2.79	1.36	2.72
9	1.36	2.73	1.33	2.66
10	1.33	2.65	1.29	2.59
11	1.27	2.54	1.26	2.52
12	1.24	2.49	1.24	2.47
13	1.22	2.43	1.22	2.44
14	1.19	2.39	1.20	2.40
15	1.17	2.34	1.14	2.28
16	1.14	2.29	1.13	2.26
17	1.13	2.26	1.11	2.22
18	1.11	2.22	1.10	2.19
19	1.08	2.15	1.05	2.10
20	1.04	2.08		
21	1.01	2.02		

Table 6.17 Factor Analysis Results for English, May Linking

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	12.90	25.79	12.62	25.23
2	1.90	3.81	2.01	4.01
3	1.83	3.65	1.76	3.52
4	1.57	3.14	1.68	3.36
5	1.52	3.04	1.57	3.14
6	1.47	2.95	1.43	2.87
7	1.39	2.77	1.32	2.64
8	1.25	2.51	1.27	2.54
9	1.22	2.44	1.24	2.48
10	1.19	2.38	1.22	2.44
11	1.18	2.36	1.18	2.36
12	1.17	2.33	1.14	2.28
13	1.06	2.12	1.10	2.19
14	1.01	2.03	1.07	2.14
15			1.04	2.07

Table 6.18 Factor Analysis Results for English, May Target

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	5.67	11.35	6.69	13.37
2	1.81	3.61	1.84	3.68
3	1.66	3.33	1.78	3.56
4	1.56	3.11	1.65	3.31
5	1.49	2.98	1.44	2.88
6	1.47	2.94	1.42	2.84
7	1.38	2.75	1.39	2.78
8	1.31	2.62	1.30	2.61
9	1.27	2.53	1.28	2.57
10	1.25	2.49	1.26	2.52
11	1.22	2.44	1.24	2.49
12	1.21	2.41	1.20	2.40
13	1.18	2.36	1.18	2.35
14	1.17	2.34	1.15	2.30
15	1.15	2.30	1.09	2.19
16	1.09	2.18	1.08	2.16
17	1.06	2.11	1.04	2.08
18	1.03	2.06	1.01	2.03
19	1.01	2.02	1.01	2.01

Table 6.19 Factor Analysis Results for Government, May Linking

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	14.74	29.47	15.61	31.22
2	1.93	3.86	1.74	3.48
3	1.66	3.31	1.60	3.20
4	1.45	2.89	1.51	3.02
5	1.41	2.81	1.40	2.79
6	1.34	2.69	1.30	2.60
7	1.29	2.58	1.25	2.50
8	1.25	2.49	1.20	2.39
9	1.18	2.36	1.15	2.31
10	1.11	2.22	1.12	2.23
11	1.08	2.16	1.09	2.17
12	1.06	2.12	1.05	2.10
13	1.01	2.02	1.01	2.02

Table 6.20 Factor Analysis Results for Government, May Target

	Form 108		Form 208	
Factor	Eigenvalue	%Var	Eigenvalue	%Var
1	6.50	12.99	6.58	13.16
2	1.86	3.71	1.90	3.81
3	1.55	3.10	1.77	3.55
4	1.51	3.02	1.66	3.31
5	1.42	2.84	1.52	3.04
6	1.38	2.77	1.41	2.83
7	1.37	2.73	1.39	2.78
8	1.33	2.67	1.33	2.67
9	1.30	2.60	1.32	2.63
10	1.25	2.50	1.27	2.54
11	1.22	2.44	1.26	2.52
12	1.20	2.39	1.21	2.42
13	1.16	2.31	1.16	2.32
14	1.14	2.29	1.14	2.28
15	1.09	2.19	1.10	2.21
16	1.08	2.17	1.07	2.15
17	1.06	2.12	1.04	2.08
18	1.04	2.07	1.02	2.05
19	1.02	2.05	1.02	2.05

Table 6.21 Distributions of P-Values: May Operational Items – Linking

	Number and Percentage of Items							
P-Value	Algebra		Biology		English		Government	
	N	%	N	%	N	%	N	%
$P < 0.10$	0	0.00	0	0.00	0	0.00	0	0.00
$0.10 \leq P < 0.20$	0	0.00	0	0.00	0	0.00	0	0.00
$0.20 \leq P < 0.30$	1	1.00	1	1.02	0	0.00	0	0.00
$0.30 \leq P < 0.40$	1	1.00	1	1.02	1	1.03	0	0.00
$0.40 \leq P < 0.50$	4	4.00	6	6.12	3	3.09	2	2.00
$0.50 \leq P < 0.60$	12	12.00	13	13.27	9	9.28	10	10.00
$0.60 \leq P < 0.70$	22	22.00	20	20.41	16	16.49	17	17.00
$0.70 \leq P < 0.80$	28	28.00	27	27.55	26	26.80	33	33.00
$0.80 \leq P < 0.90$	26	26.00	24	24.49	34	35.05	29	29.00
$P \geq 0.90$	6	6.00	6	6.12	8	8.25	9	9.00
Descriptive Statistics								
N Items*	100		98		97		100	
Mean	0.72		0.71		0.74		0.75	
SD	0.14		0.14		0.13		0.11	
Min	0.29		0.23		0.31		0.48	
Max	0.96		0.93		0.93		0.94	

* N Items includes the number of unique items; some Biology and English items appear on both Forms 108 and 208.

Table 6.22 Distributions of P-Values: May Operational Items – Target

	Number and Percentage of Items							
P-Value	Algebra		Biology		English		Government	
	N	%	N	%	N	%	N	%
$P < 0.10$	0	0.00	0	0.00	0	0.00	0	0.00
$0.10 \leq P < 0.20$	0	0.00	1	1.02	1	1.03	0	0.00
$0.20 \leq P < 0.30$	7	7.00	7	7.14	1	1.03	4	4.00
$0.30 \leq P < 0.40$	21	21.00	20	20.41	19	19.59	21	21.00
$0.40 \leq P < 0.50$	32	32.00	27	27.55	27	27.84	36	36.00
$0.50 \leq P < 0.60$	22	22.00	22	22.45	24	24.74	23	23.00
$0.60 \leq P < 0.70$	13	13.00	17	17.35	21	21.65	13	13.00
$0.70 \leq P < 0.80$	5	5.00	4	4.08	4	4.12	3	3.00
$0.80 \leq P < 0.90$	0	0.00	0	0.00	0	0.00	0	0.00
$P \geq 0.90$	0	0.00	0	0.00	0	0.00	0	0.00
Descriptive Statistics								
N Items*	100		98		97		100	
Mean	0.47		0.48		0.50		0.48	
SD	0.13		0.13		0.12		0.11	
Min	0.23		0.16		0.18		0.23	
Max	0.79		0.79		0.76		0.79	

* N Items includes the number of unique items; some Biology and English items appear on both Forms 108 and 208.

Table 6.23 Distributions of Point-Biserial Correlations: May Operational Items – Linking

May 2008	Number and Percentage of Items							
Correlation	Algebra		Biology		English		Government	
	N	%	N	%	N	%	N	%
$R < 0.10$	0	0.00	1	1.02	0	0.00	0	0.00
$0.10 \leq R < 0.20$	4	4.00	5	5.10	0	0.00	1	1.00
$0.20 \leq R < 0.30$	16	16.00	17	17.35	23	23.71	6	6.00
$0.30 \leq R < 0.40$	40	40.00	34	34.69	43	44.33	29	29.00
$0.40 \leq R < 0.50$	35	35.00	36	36.73	28	28.87	52	52.00
$0.50 \leq R < 0.60$	4	4.00	5	5.1	3	3.09	12	12.00
$0.60 \leq R < 0.70$	1	1.00	0	0.00	0	0.00	0	0.00
$R \geq 0.70$	0	0.00	0	0.00	0	0.00	0	0.00
Descriptive Statistics								
N Items*	100		98		97		100	
Mean	0.37		0.37		0.37		0.41	
SD	0.09		0.09		0.08		0.08	
Min	0.18		0.09		0.23		0.13	
Max	0.61		0.54		0.53		0.56	

* N Items includes the number of unique items; some Biology and English items appear on both Forms 108 and 208.

Table 6.24 Distributions of Point-Biserial Correlations: May Operational Items – Target

May 2008	Number and Percentage of Items							
Correlation	Algebra		Biology		English		Government	
	N	%	N	%	N	%	N	%
$R < 0.10$	1	1.00	6	6.12	3	3.09	2	2.00
$0.10 \leq R < 0.20$	15	15.00	17	17.35	15	15.46	12	12.00
$0.20 \leq R < 0.30$	37	37.00	36	36.73	41	42.27	40	40.00
$0.30 \leq R < 0.40$	37	37.00	33	33.67	32	32.99	41	41.00
$0.40 \leq R < 0.50$	10	10.00	6	6.12	6	6.19	4	4.00
$0.50 \leq R < 0.60$	0	0.00	0	0.00	0	0.00	1	1.00
$0.60 \leq R < 0.70$	0	0.00	0	0.00	0	0.00	0	0.00
$R \geq 0.70$	0	0.00	0	0.00	0	0.00	0	0.00
Descriptive Statistics								
N Items*	100		98		97		100	
Mean	0.29		0.26		0.27		0.29	
SD	0.09		0.10		0.09		0.09	
Min	0.06		-0.03		-0.04		0.05	
Max	0.48		0.48		0.45		0.50	

* N Items includes the number of unique items; some Biology and English items appear on both Forms 108 and 208.

Table 6.25 Summary Statistics of Tetrachoric Correlations by Sample, Content, and Form

Sample	Content	Form	Mean	Std Dev	Minimum	Maximum
Linking	Algebra	108	0.206	0.101	-0.120	0.747
		208	0.220	0.102	-0.077	0.581
	Biology	108	0.211	0.106	-0.076	0.524
		208	0.203	0.111	-0.072	0.533
	English	108	0.233	0.094	-0.042	0.627
		208	0.223	0.103	-0.060	0.638
	Government	108	0.266	0.107	-0.072	0.703
		208	0.286	0.104	0.020	0.633
Target	Algebra	108	0.104	0.083	-0.236	0.395
		208	0.099	0.079	-0.114	0.424
	Biology	108	0.071	0.082	-0.196	0.338
		208	0.081	0.088	-0.259	0.402
	English	108	0.081	0.071	-0.180	0.337
		208	0.102	0.077	-0.094	0.346
	Government	108	0.097	0.075	-0.088	0.506
		208	0.097	0.083	-0.145	0.338

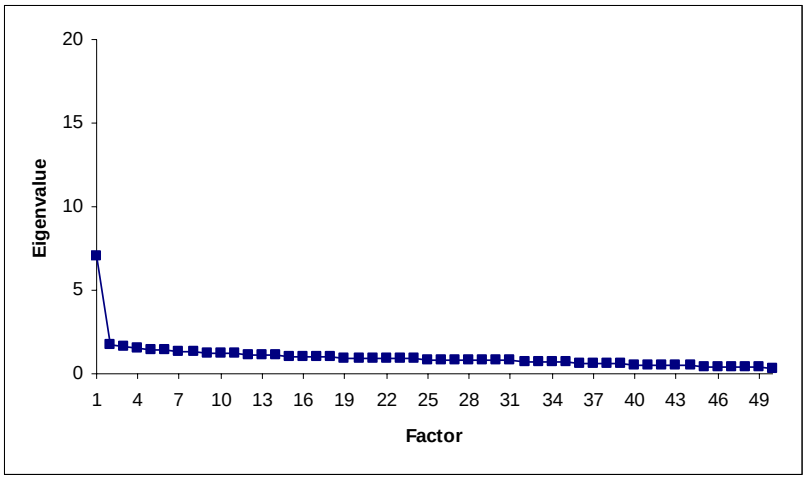

Figure 6.1 Scree Plot: Algebra - Target Population - Form 108

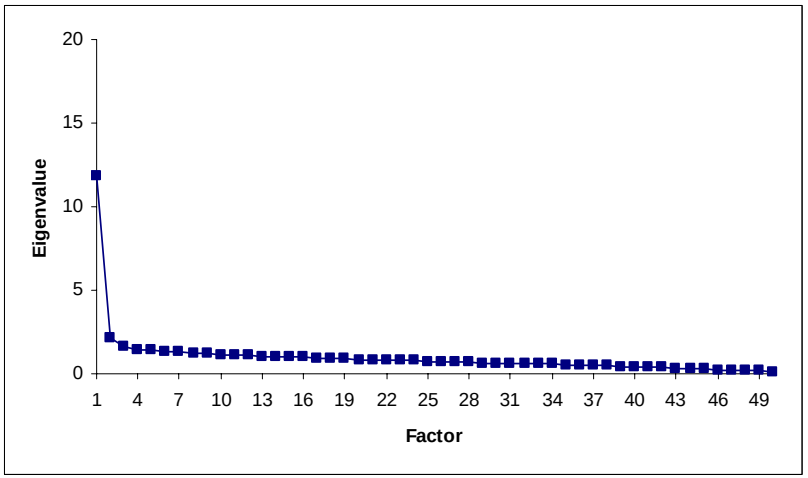

Figure 6.3 Scree Plot: Algebra - Linking Sample - Form 108

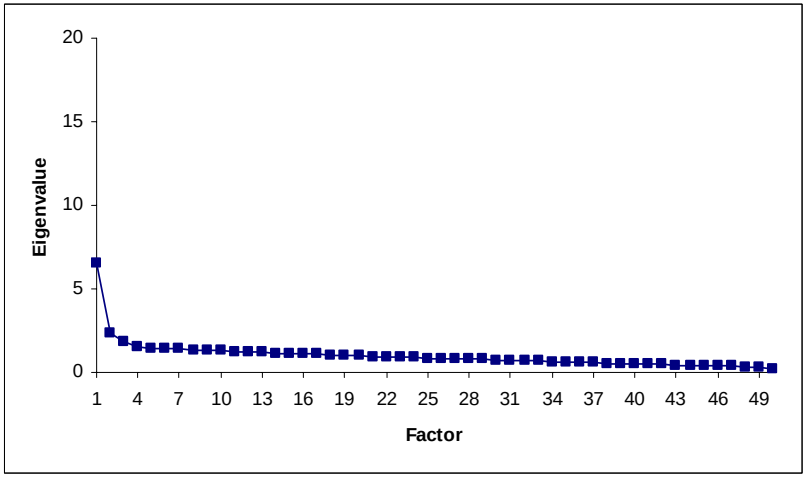

Figure 6.2 Scree Plot: Algebra - Target Population - Form 208

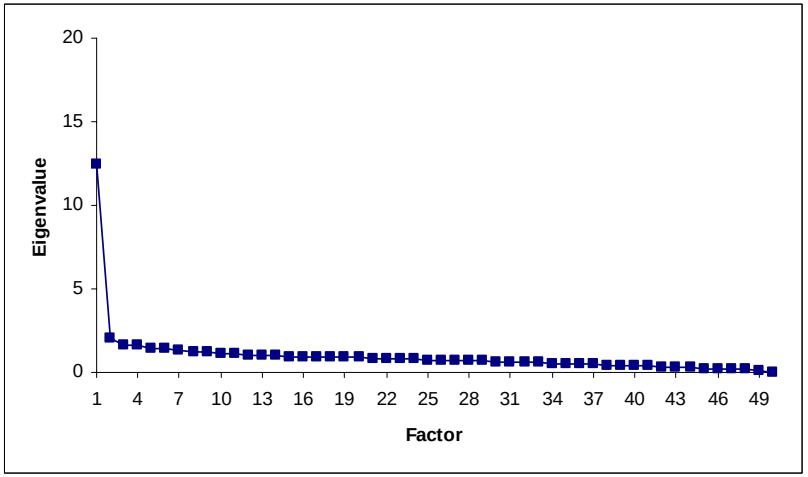

Figure 6.4 Scree Plot: Algebra – Linking Sample - Form 208

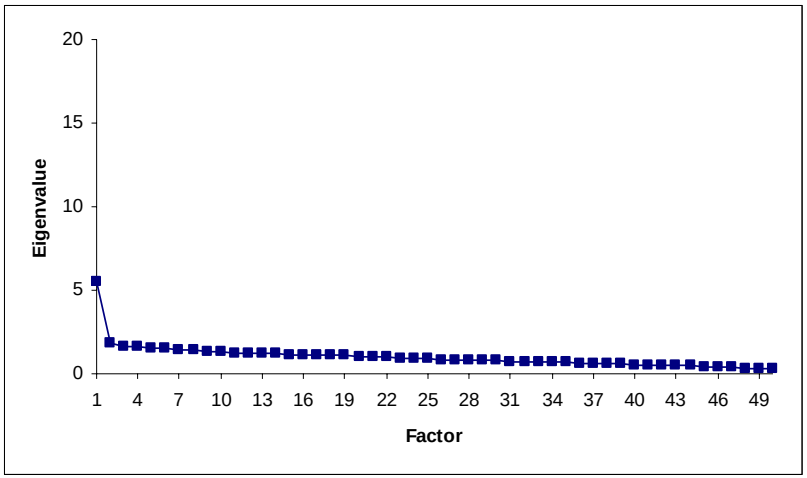

Figure 6.5 Scree Plot: Biology – Target Population - Form 108

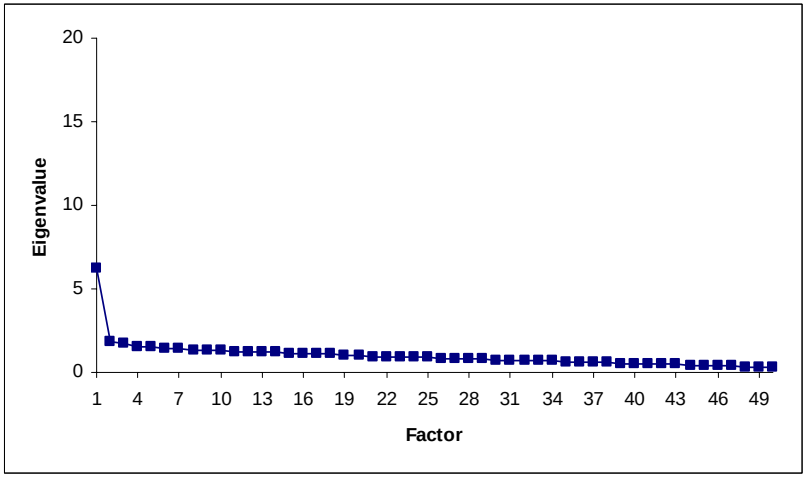

Figure 6.6 Scree Plot: Biology – Target Population - Form 208

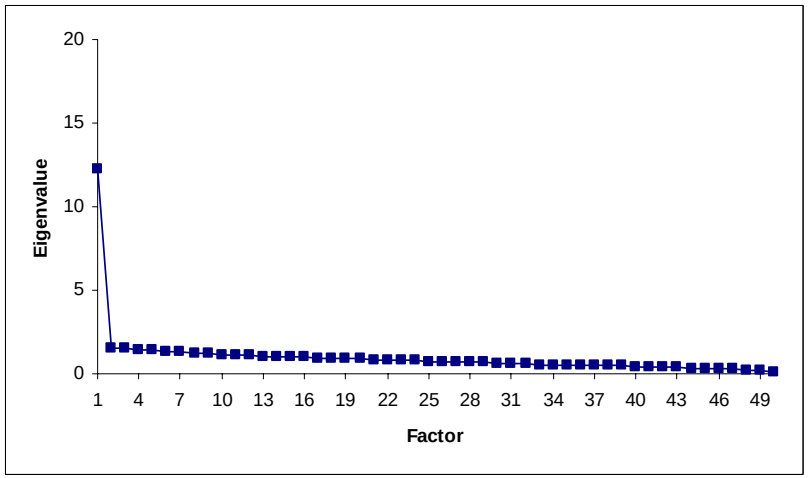

Figure 6.7 Scree Plot: Biology – Linking Sample - Form 108

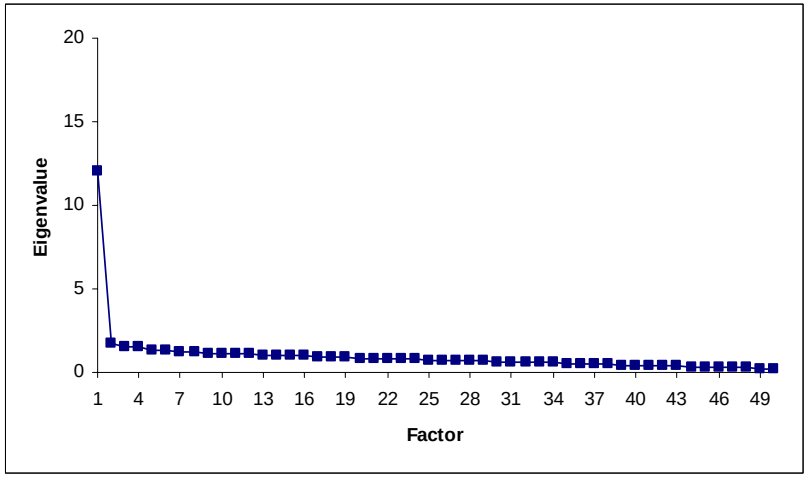

Figure 6.8 Scree Plot: Biology – Linking Sample - Form 208

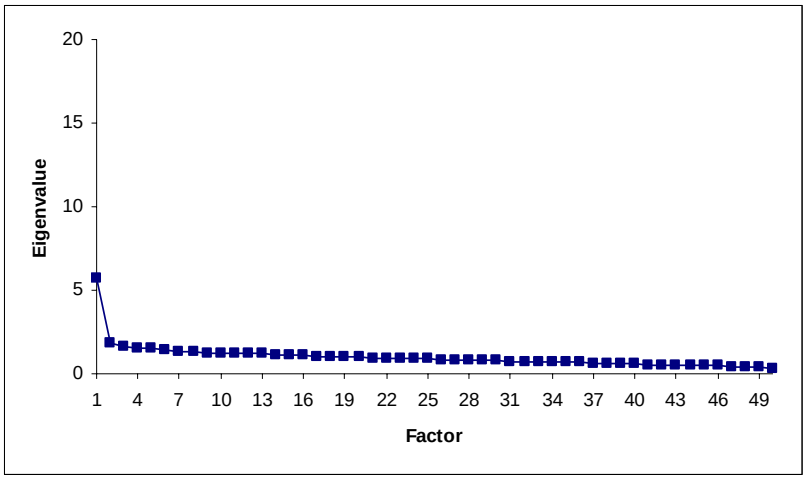

Figure 6.9 Scree Plot: English - Target Population - Form 108

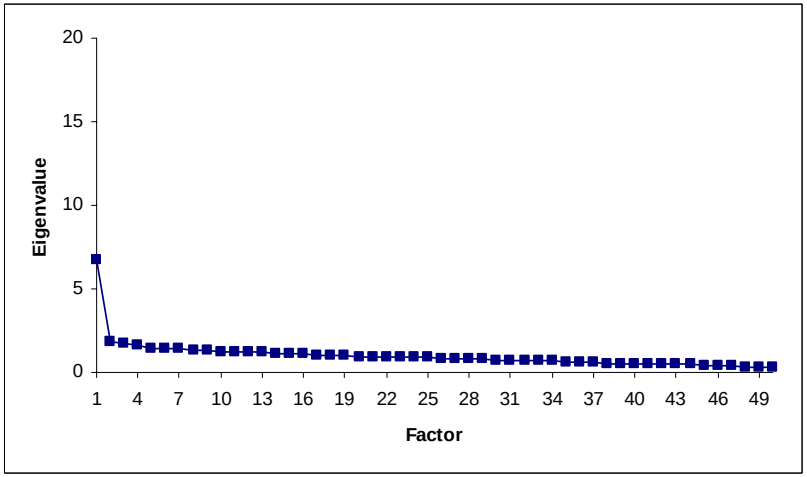

Figure 6.10 Scree Plot: English – Target Population - Form 208

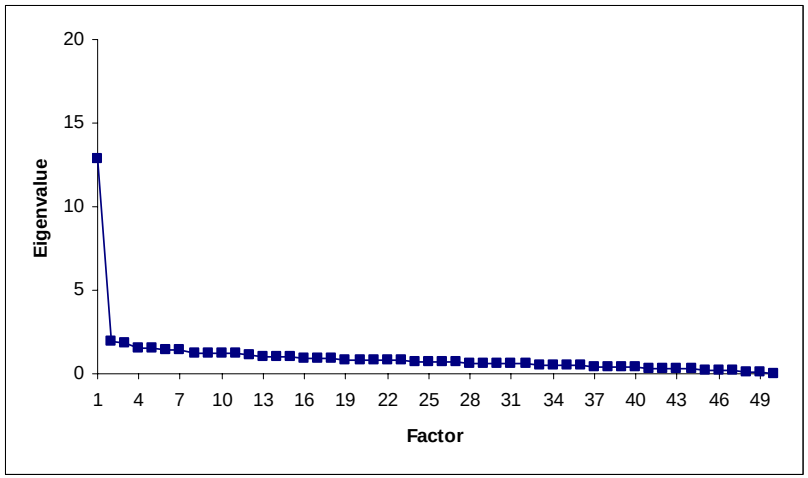

Figure 6.11 Scree Plot: English – Linking Sample - Form 108

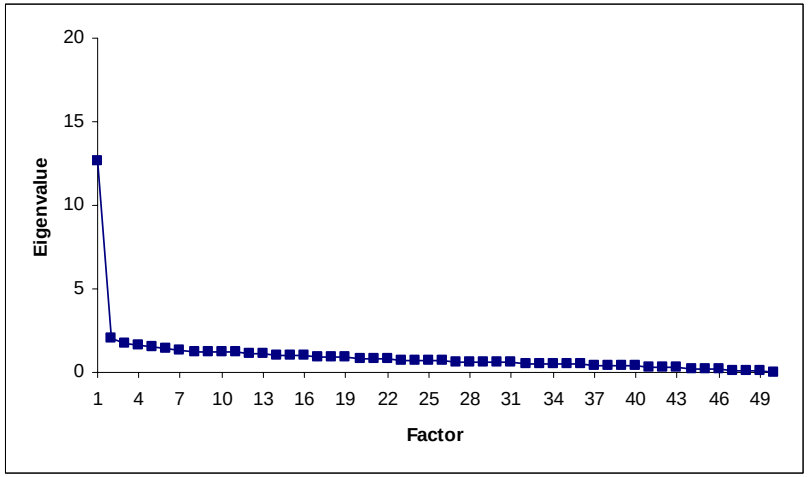

Figure 6.12 Scree Plot: English – Linking Sample - Form 208

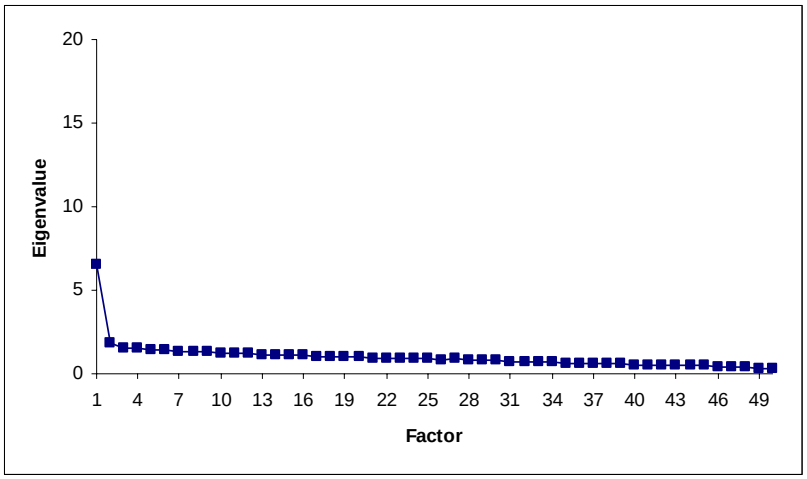

Figure 6.13 Scree Plot: Government - Target Population – Form 108

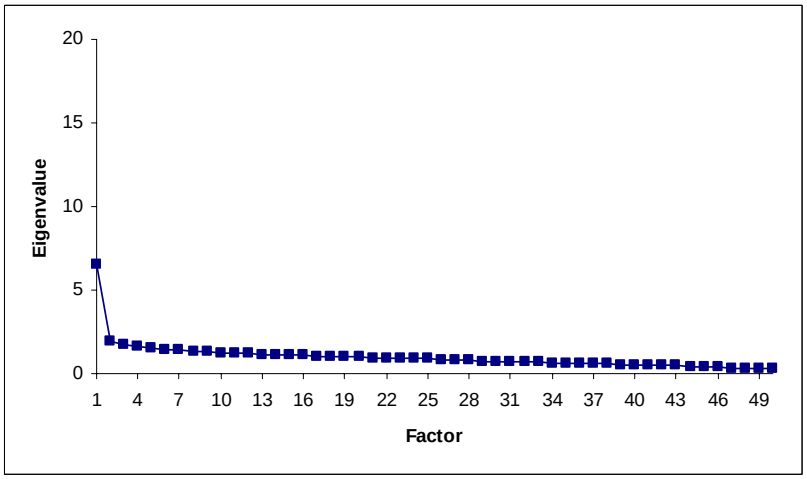

Figure 6.14 Scree Plot: Government - Target Population – Form 208

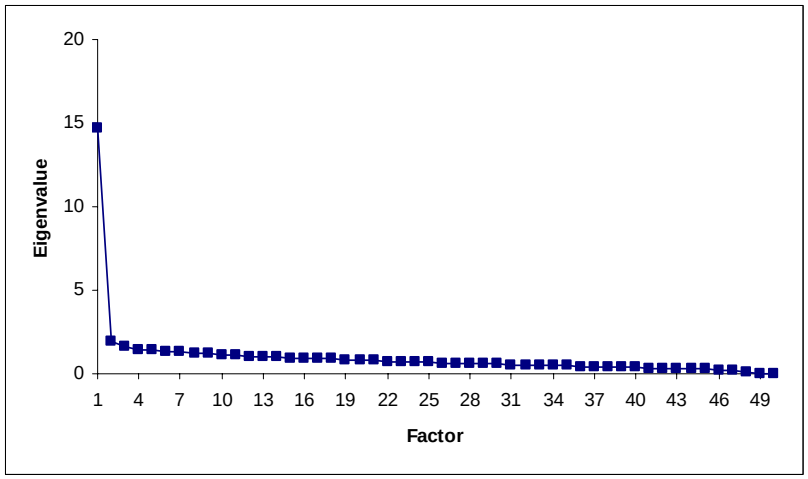

Figure 6.15 Scree Plot: Government – Linking Sample – Form 108

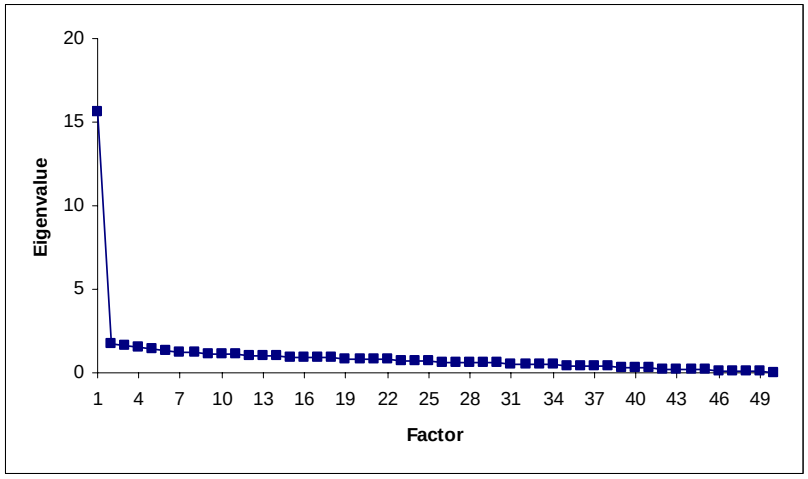

Figure 6.16 Scree Plot: Government – Linking Sample – Form 208